METAMORPHOSIS
AUSTRALIA

Magazine of the Butterfly & Other Invertebrates Club Inc.

http: //www.boic.org.au

Issue: 101 June 2021 ISSN: 1839-9819

BUTTERFLY & OTHER INVERTEBRATES CLUB INC.

Aims of the organisation

- To promote the importance of invertebrates in the environment
- To hold information meetings and organise excursions around the theme of invertebrates
- To promote the conservation of the invertebrate habitat and encourage the growing of butterfly host plants
- To promote research into invertebrates
- To encourage the construction of invertebrate friendly habitats in urban areas

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Membership

Annual fees are $30 for families, individuals, schools, organisations.
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General meetings

Quarterly meetings, are held with guest speakers to organise BOIC events.

Deadlines for publishing in *Metamorphosis Australia*

If you wish to submit an item for the publication the following deadlines apply:
March issue –1 February, June issue – 1 May, September issue – 1 August,
December issue – 1 November.
All articles should be submitted directly to the Editorial Committee secretaryboic@gmail.com.
This publication has been produced with the co-operation and combined efforts of the editorial committee, individual contributors, artists and photographers.

Disclaimer

This publication seeks to be as scientifically accurate as possible. The views opinions and observations expressed are those of the authors. It is a platform for people, both amateur and professional, to share information, news and images of butterflies and other invertebrates. The submitted manuscripts are reviewed with editorial changes suggested if applicable. The editorial committee reserves the right to refuse to publish matter that it deems unsuitable for publication.

Cover image: Glasswing, *Acraea andromacha.* Painting courtesy of Lois Hughes

Hello from the President

Welcome to our new-look *Metamorphosis Australia*. The BOIC committee trusts that you like the new presentation.

As alluded to in Issue 100, the then president indicated some management changes were afoot. Thus, there have been a couple of reshuffles of committee members with new roles for some. Our faithful and hard-working retired president, Ross, has now retired from the committee and I thank him here for a job well done and his solid commitment as president for the better part of 15 years. In addition, we give our thanks, best wishes and blessings to our retiring Vice President Richard Zietek and our magazine editor Daphne Bowden. We are especially grateful to them for many years of valued service and their efforts have made the club what it is today. David Exton moves up to the role of Vice President, while Dr Bernie Franzmann and Jon Hartas join the committee. Our stalwarts Dawn Franzmann and Rob MacSloy remain in their current roles, always providing sound and reliable support to the club.

Issue 101 is jam packed with solid articles, with the genus *Acraea* taking centre stage in this edition. Wesley Jenkinson is never disappointing, with his summary of *A. andromacha*. This will contribute to a good baseline for this species, especially with the arrival of *A. terpsicore* into our region, which we are still unsure of its potential impact on our endemic *A. andromacha*. Russell Denton and Dawn Franzmann provide us with the full story of the arrival of *A. terpsicore* at Boondall, and Dr John Moss provides an interesting article on some aberrant *Acraea* species to possibly look out for. The articles keep coming with the final story, a wrap up of the excellent presentation on Lycaenid butterflies given by Dr Peter Samson after the General Meeting at Karawatha Forest Discovery Centre on 15 May 2021.

Finally, may I take this opportunity to thank all the contributors to Edition 101 and of course the committee always welcomes feed-back.

My sincere regards

Trevor

Life history notes on the Glasswing, *Acraea andromacha* (Fabricius, 1775) (Lepidoptera: Nymphalidae: Heliconiinae)

Wesley Jenkinson

Introduction

This common butterfly is known from across much of the Australian mainland with records from all states (Braby 2016) (Fig. 1, 2). The infilled map showing the butterfly's range in Braby (2000) has been extended in Braby (2016) to incorporate a continuous distribution across much of the northern half of Australia. This is likely because of new intervening data that have been collected in recent times, rather than a range extension per se. During favourable wet seasons the adults can disperse well away from breeding sites into inland and southern regions.

The butterfly frequents a wide range of habitats from rainforest margins to open woodlands and grasslands where the host plants grow. Glasswings often visit suburban gardens in search of nectar if they are breeding nearby. Both sexes readily feed on the nectar of a range of native and exotic flowers and while feeding often open and close their wings slowly.

They normally fly within a few metres of the ground but also fly much higher when in search of nectar. They have a rather slow, gliding flight, but are capable of fast speeds when disturbed. Flight occurs in both sunny and warm cloudy conditions, and the male butterflies hilltop strongly from mid-morning to late afternoon depending on temperature and weather conditions. While hill topping, the males chase one another constantly and often settle on the end of small twigs. Adults are known to roost in small clusters (Braby 2000).

Within Queensland, specimens are variable in size, and the black spots on the upper and undersides of the wings can vary slightly in size and shape.

Sexes are very similar in appearance. Females are generally larger in size, the forewing sometimes being slightly broader with the termen slightly more rounded (Figs 3-6). After mating, the male leaves a secretion creating a hard plug when dried, called a sphragis (Fig. 7) which blocks the female from further mating. Sexes are best distinguished by examining the external genitalia (Braby 2000) (Figs 7, 8).

Native and exotic host plants in the Violaceae and Passifloraceae have been reported (Braby 2000, Sankowsky 2020). Known native host plants include *Adenia heterophylla*, *Hybanthus aurantiacus, H. enneaspermus, Passiflora aurantia, P. cinnabarina* and *P. herbertiana* (Fig. 25), plus another five exotic and weedy *Passiflora* species including the naturalised *P. foetida*. Eggs that are sometimes laid on two commercially grown exotic species *P. edulis* (Common Passionfruit) and

P. quadrangularis (Granadilla) result in larval mortality (Braby 2000). In south eastern Queensland, *H. stellarioides* (Fig. 9) is also a host plant with an observation of a female ovipositing on *H. monopetalus.* (Sands 2004) (Fig. 24).

Figs 1, 2. Adult female of *Acraea andromacha*

Since Braby (2000), the status of the Australian *Hybanthus* has been reclassified with several genera now proposed for this group (i.e. *Afrohybanthus* and *Pigea*) (Forster 2021). For simplicity, in this work, I have retained the species in *Hybanthus.*

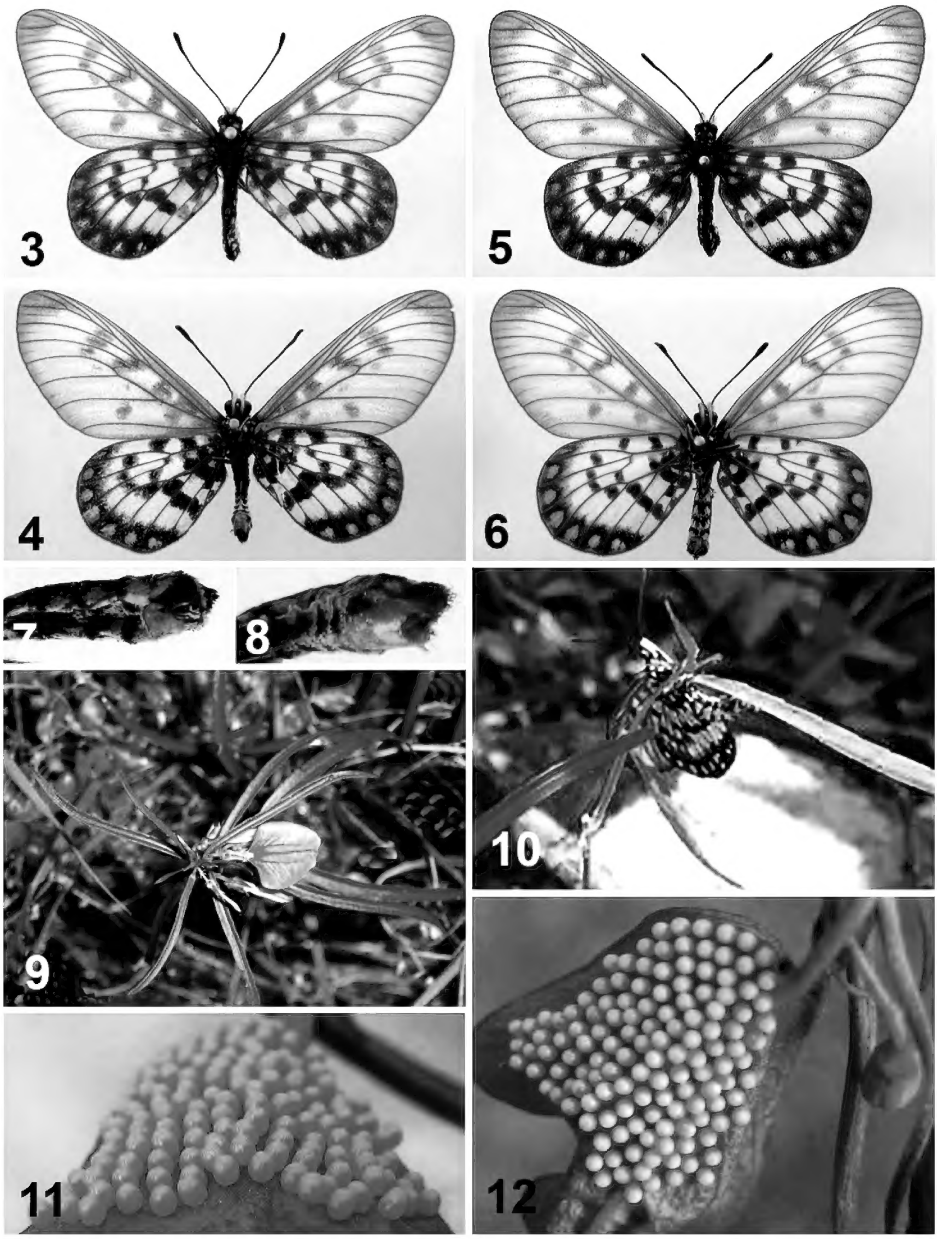
Life history

The life history of *A. andromacha* has been well documented by Braby (2000). Ovipositing females flutter slowly close to the ground around the host plants and keep their wings closed while ovipositing (Fig. 10). The eggs are laid in clusters, ranging from 14-150 eggs (Braby 2000) (Figs 11, 12), principally on the underside of fresh and older leaves and occasionally along a stem of the host plant. Females will oviposit at ground level if suitable host plants are available.

Egg, yellow, barrel shaped with rounded apex, approximately 0.9 mm high × 0.7 mm wide, with 18-21 broad slightly raised vertical ridges (Fig. 12). In captivity, first instar larvae hatched at roughly the same time during early morning and larvae consumed their eggshells soon after hatching and then fed on the epidermis of the leaf (Fig. 13). Larvae rested on spun silk and fed from the edges of the leaves and were observed feeding during daylight hours. Early instar larvae fed gregariously (Fig. 14) and when progressing to later instars they become solitary (Fig. 15).

Larvae completed five instars and attained a maximum length of 33 mm (Figs 15-20). Larvae are known to be cannibalistic if raised in captivity (Braby 2000), however I did not observe this.

In captivity, the pupae, measuring 19-22 mm in length, were located either under a stem of the host plant or hung from the top of the raising cage (Figs 21-24).



Figs 3-12. *A. andromacha* – **3** male upper, **4** male under, **5** female upper, **6** female under, **7** male abdomen, **8** female abdomen showing sphragis, **9** *Pigea* (*Hybanthus*) *stellarioides* (Spade Flower), **10** ovipositing on *P.* (*H.*) *stellarioides*, **11, 12** egg clusters.

They were attached with silk hanging by the cremaster with the head suspended downward. Under natural conditions the larvae often leave the host plant and pupate below a nearby grass stem or a leaf on a nearby shrub and are often parasitised. They are occasionally found suspended from man-made objects if these are nearby the host.

The duration of the life cycle varied considerably with the first adult emerging at 59 days and the final adult emerging at 93 days. The first adult had an egg duration of 9 days, a larval duration of 31 days and a pupal duration of 19 days. Being April and heading into winter may have also had some bearing on the protracted emergence times. Within the boundary of the Scenic Rim Regional Shire south of Brisbane, I have records of adults from all months of the year, being less numerous in the winter months. There are likely to be several generations per year in this region.

During April 2020, an egg cluster was collected from the weedy exotic, Corky Passion Vine (*P. suberosa*) growing in my garden in Beaudesert in south eastern Queensland. Larvae were raised through to adults. About 70% of the larvae pupated with only a few individuals failing to emerge from their pupal cases. This is contrary to that reported by Sankowsky (2020) who indicated that larvae died when raised on the exotics *P. suberosa* and *P. subpeltata*.

In future years it will be interesting to see if Glasswings are affected in some way by the recent invasion of the Tawny Coster.

Acknowledgements

I would like to thank John Moss for commenting on the manuscript.

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Figs 13-23. *A. andromacha* life history – **13** first instar larvae soon after hatching, **14** gregarious early instar larvae, **15** first instar larva, **16** second instar larva, **17** third instar larva, **18** fourth instar larva, **19** final instar larva, **20** final dark form, **21** prepupa (lateral view), **22** pupa (lateral view), **23** pupa (dorsal view).

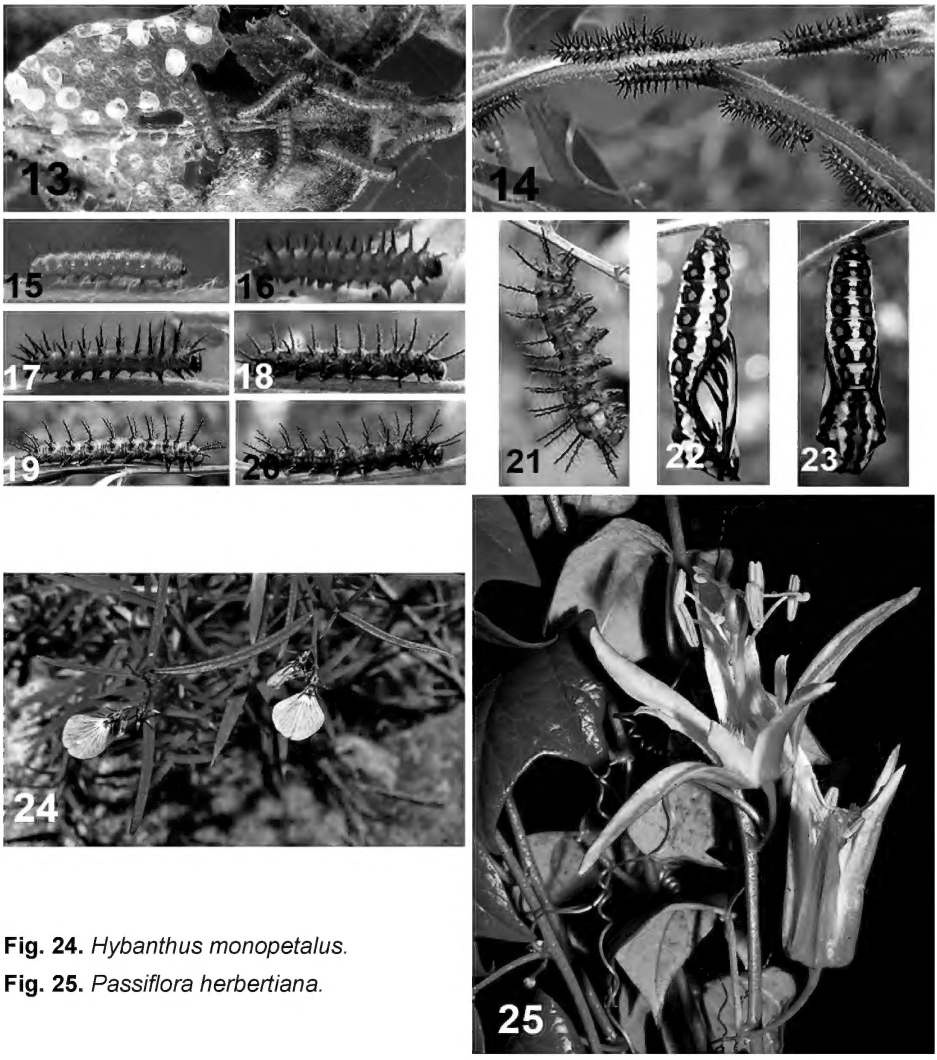


Fig. 24. *Hybanthus monopetalus.*

Fig. 25. *Passiflora herbertiana.*

The first record of *Acraea terpsicore* (Linnaeus, 1758) (Tawny Coster butterfly) (Lepidoptera: Nymphalidae: Heliconiinae) from Brisbane, Qld

Russel Denton

On February 19, 2021, I was invited by Jutta Godwin, who is leading Brisbane's Big Butterfly Count project, to lead a group through Boondall Wetlands. The group consisted of Jutta Godwin, Cliff Meyer and several others. I had been watching out for Tawny Costers (*Acraea terpsicore*) in the wetlands all summer.

Surprisingly, it wasn't too long before we sighted a Tawny Coster along one of the walking tracks (Fig. 1). After this surprising sighting, I excitedly first contacted, Dawn Franzmann, Ross Kendall and John Moss. They were equally excited to hear the news of my find.

In the following days, Dawn contacted me, and we discussed the possibility of a few other interested people going to Boondall Wetlands in an attempt to sight it again. I offered to lead them to the location where I had seen the butterfly. I quickly rearranged my roster and was able to meet Dawn and Bernie Franzmann and a couple of friends on Saturday 27 February. Because Boondall Wetlands is a delicate environment, too many people not keeping to defined walking tracks is discouraged (Fig. 2).

Soon after we set off, we sighted the Tawny Coster in the same location as the week before. Within a few minutes we observed several more Tawny Costers and we witnessed a rare event. We observed a male Tawny Coster, (*A. terpsicore*) mating with a female Glasswing, (*A. andromacha*). Dawn and I managed to take several photos of this event. This will be fully reported on in a subsequent article.

We returned to the sight the next morning and this time Chris Sanderson joined us, and yes, the Tawny Costers were still flying. With this exciting discovery and confirmed sighting in the Boondall Wetlands, the question has been raised as to whether the Tawny Coster will become a pest or a friend. Only time will tell, thus more observations of this species at the wetlands will be vital.

Fig. 1. Female *Acraea terpsicore*, Boondall Wetlands.

Fig. 2. Open savannah woodland habitat, Boondall Wetlands.

Mating of the Tawny Coster, *Acraea terpsicore* (Linnaeus, 1758) with a Glasswing, *A. andromacha* (Fabricius, 1775), (Lepidoptera: Nymphalidae: Heliconiinae) observed at Boondall Wetlands, Boondall, Brisbane, Qld

Dawn Franzmann

Following on from Russel's account of the now widely-known sighting of the Tawny Coster, *Acraea terpiscore* in the Boondall Wetlands, Brisbane, Queensland, I would like to share my story and also a little more of Russel's story and some earlier history about its sighting in the Northern Territory. The Boondall Wetlands are part of the network of environmental parks administered by the Brisbane City Council (BCC).

At the outset I would like to establish that this story is not meant to be a scientific reference or in any way take the place of the previous article on the Tawny Coster, published in *Metamorphosis Australia*, **100**: March 2021. I had heard about the Tawny Coster quite a few times since its confirmed sighting in Darwin in 2012 from Chris Sanderson. Chris was holidaying on the Cox Peninsula near Darwin and set out for a bush walk at a place called Wagait beach tracks in Darwin. Along the way he spotted a small orange butterfly that looked rather like an orange Glasswing butterfly (*A. andromacha*). Knowing that he hadn't seen this butterfly recorded in any of the published books on the subject, he couldn't wait to get back to his accommodation and run some checks. His suspicion of stumbling upon something significant was easily verified as his sighting fitted the description of a number of overseas *Acraea* butterflies, including the Tawny Coster.

He sent photos to Professor Michael Braby and outlined his story and the sighting. When he heard back from Michael, he was informed that another sighting has been reported 150 km south of Darwin a few weeks after Chris's sighting. This was the beginning of a rewarding scientific collaboration between these two scientists. It has resulted in the formation of the Butterflies Australia Project and the accompanying App.

I remember checking the Butterfly & Other Invertebrates Club Inc. (BOIC) Facebook group on the afternoon of the 4 November 2020 whereupon I read a post from our member Mark Korner which contained some photos of the Tawny Coster. He had sighted it on his sister's property, at Glen Cairn near Gatton in Queensland. There was great excitement within the BOIC community as the butterfly had been working its way down the coast of Queensland and was it now within our reach. Other unconfirmed sightings were coming to the fore, some of which John Moss and Peter Hendry have touched upon in their article in the March edition of Metamorphosis Australia.

Russel Denton is also a member and a regular contributor to the BOIC Facebook

group. He also noted the post with much interest. A few days later, he called me and we had a long conversation about the possibility of us ever being able to sight one in Brisbane with his belief that he may see it at Boondall Wetlands.

He shared with me his hypothesis and it went something like this: Russel was working on the fact that the Tawny Coster is a tropical butterfly which likes a savannah/wetlands type of environment. Perhaps, this is why it made its way across the top of Australia to Cape York, Cairns and Townsville. His main thought was that the Tawny Coster and the Glasswing butterfly both shared the same *Passiflora* host plant. It was in abundance in the Boondall Wetlands and he felt very strongly that it was only a matter of time before it would reach the wetlands. The environment is similar to the savannah and wetlands of the topics. I considered this from a common-sense viewpoint and thought why not!!!

I should add that Russel Denton is a valued member of BOIC and a volunteer for the Brisbane City Council working at their environmental centres around Brisbane. He is highly sought after to give guided walks around the centres and he especially loves the many tracks that make up the Boondall Wetlands.

Fast forward to Friday 19 February when Russel was guiding a group from the Brisbane's Big Butterfly Count to conduct a survey to record butterflies from Boondall Wetlands. As previously described by Russel in his account it wasn't too long before they sighted the Tawny Coster.

I feel very privileged that he then called me to relay the news and in quick succession made a couple of more calls. I could hear in his voice his excitement as he said, "Dawn I am at Boondall and guess what, the Tawny Coster, it is here".

A few days later I spoke with Russel and he offered to meet my husband Bernie and a couple of friends and myself at the wetlands and escort us to the location where had spotted it the week before. As arranged, we met Russel on Saturday 27 February and commenced our walk down the track. This was to be a private visit and not considered an official BOIC excursion. Russel was able to guide us, a small group, through the thick undergrowth. The chance of the Tawny Coster still being in the same area was considered slim by some people but being the ultimate optimist, I wasn't going to let these comments dampen my enthusiasm.

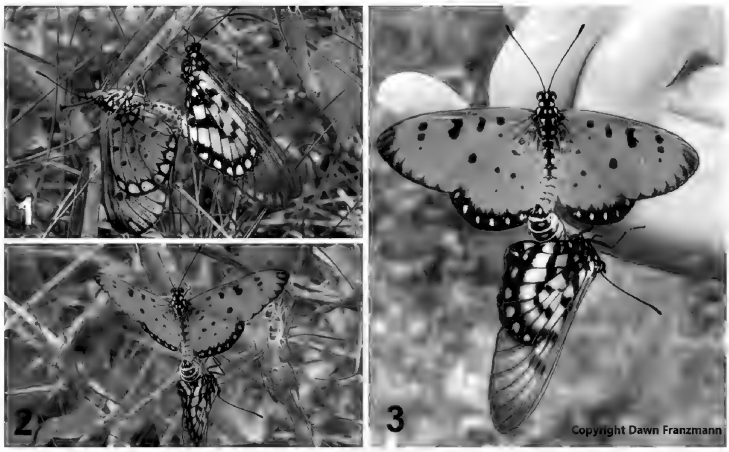
Upon, reaching the location, it was only a matter of minutes before we witnessed the Tawny Coster in flight and it seemed to be daring us to follow it around the twist and turns of the thick undergrowth, which was mainly *Polymeria calycina*. Russel patiently followed it, with us trailing behind in awe of this beautiful butterfly. Eventually, it landed and low and behold it was not one but two butterflies (Fig. 1). Bernie picked them up very gently in his hands and what we were witnessing was a male Tawny Coaster and a female Glasswing mating. We had seen three Tawny

Costers in that location. Our astonishment and amazement as to what we were witnessing was reflected in our childlike excitement and exclamations. It didn't take us long to realise that what we were witnessing was indeed rare, two butterflies of different species mating (Figs 2 and 3) and to be able to capture the event on video and digital photography. As an older person, did I ever think I would be able to experience this feeling of awe and childlike wonder ever again.

Russel and I were the only ones in the group to have cameras. So, we clicked our devices many times over to obtain the best shots possible and also managed to record the mating on a few video clips. I might add, the clicking of our cameras was accompanied by a chorus of "did you get it; did you get it?". Once again, a couple of excited phone calls were made to interested persons to tell of this very rare occurrence. It took the five of us a little while to regain our composure and formulate the plan to visit again the next morning. On Sunday 28 February Chris Sanderson accompanied us to the same spot. We were lucky in that we sighted four on this morning. We noted that there were three types of vines on the trees in this area, *Passiflora subpelata, P. foetida* and *Parsonsia straminea.*

As I write this story, the realisation that this beautiful butterfly may prove to be a detrimental immigrant into Australia comes into my mind. I ask myself the question will it be blessing or a curse? It may prove to be a pest of passionfruit. It may outcompete related species such as the Glasswing for food resources. It may prove to be a beneficial bio-control agent for introduced *Passiflora* weed species.

I would like to dedicate my part of this story to Russel Denton, BOIC member and volunteer at the BCC Environmental Centres for his persistence, patience and belief that it was only a matter of time before we saw the Tawny Coster within the boundary of Brisbane. Thank you, Russel, for including us in this most historical and exciting event.



Figs 1-3. Male *Acraea terpsicore* observed mating with female *A. andromacha* at Boondall Wetlands, Brisbane.

Some research into butterfly hybrids

Bernie Franzmann

In February this year, I was there with Russell Denton when he spied a male Tawny Coster (*Acraea terpsicore*) mating with a female Glasswing (*A. andromacha*), at Boondall Wetlands, Brisbane (see articles by Denton and Franzmann – this magazine). The two species remained *in copula* for at least half an hour.

I have never seen, or indeed heard of, interspecific mating in insects. I started to wonder if the mating was successful, would hybrids be produced?

I guess that most of us have heard of the mule, being the offspring of a male donkey and female horse. Also, perhaps, heard of a liger; the offspring of a male lion and a female tiger. These mammalian hybrids are sterile. If a butterfly hybrid was produced, from the mating of these butterflies of different species, I assumed that it would be sterile.

With all these thoughts occupying my mind, when I arrived home, I immediately started to research the subject of insect hybrids. Well, I found out quite a bit, and am now much better educated, and am an example of the old maxim – you are never too old to learn.

I was always of the opinion that all hybrids were sterile, but the further I delved into the matter, I found that it was not so. Not only are they not necessarily sterile but, in some cases, hybridization has led to the development of new species (hybrid speciation).

A fly in the USA, with the common name, Lonicera fly is a hybrid between two species, *Rhagoletes mendax* and *R. zephyra*. Its larvae feed on the berries of species of introduced honeysuckle (*Lonicera*) that were brought to America within the last 250 years, as ornamental plants. Schwarz *et al.* (2005) have suggested that it most likely developed within that time by hybridization. A few decades ago, we were unaware of many of these hybrids but now, with DNA analysis, quite a few cases of animal species, arising from hybridization, are known. Perhaps I may be excused, for not knowing about this, as when I was studying biology, Watson and Crick were still in short pants.

What about butterfly hybrids? I found that the butterflies, *Colias eurytheme* and *C. philodice* are known to produce viable hybrid offspring (Grula and Taylor 1980). I also discovered that hybrid speciation may have produced the diverse *Heliconius* butterflies (Mallet *et al.* 2007). Baidya *et al.* (2018) reported observations in India of interspecific mating between the Plain Tiger (*Danus chrysippus*) and the Orange Tiger (*D. genutia*). They saw this on two separate occasions and successfully reared offspring, from one mating, to the adult stage. Ross Kendall told me that Jon Middleweek of

Albany, Western Australia, told him a few years ago, that he saw a male Common Eggfly (*Hypolimnas bolina*) mating with a female Common Crow (*Euploea corinna*) in captivity. Note that these two species are in different genera and subfamilies.

I mentioned to Don Sands, about what we saw at Boondall and he told me about a study he did with Phil Sawyer (Sands and Sawyer 1977). They recorded the results of a natural mating between two different birdwing butterflies (*Troides oblongomacultus papuensis* and *Ornithoptera priamus poseidon*) near Lae, in Papua New Guinea. The observation of the mating was by Phil's daughter, Bronwyn. They reared two male hybrids. He told me that another butterfly man at the time (Ray Straatman) decided to artificially cross the two species to produce hybrid specimens, which he sold to collectors.

Baidya *et al.* (2018), provided an extensive discussion of this topic in an online journal *Psyche*. So, if you are interested in finding out more about interspecific hybridization in butterflies and other insects, you can read all about it there.

One final comment. We did not see any courtship behaviour before the mating. I have since found out that that male *Acraea* butterflies dominate copulation behaviour without any pre-copulation ritual (Sourakov and Emmel 1997). On the day we saw the interspecific mating, in an area of about 100 m^2, we saw four Tawny Costas and at least 100 Glasswings. Perhaps, the male Tawny Costa was desperate to mate and could not find a conspecific female.

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Interesting aberrant forms of *Acraea andromacha* (Glasswing) (Fabricius, 1775) (Lepidoptera: Nymphalidae: Heliconiinae) and a related African species, *A. horta* (Linnaeus, 1764)

John T Moss

The invasive Tawny Coster, *Acraea terpsicore*, has been much in the news of late and probably will be more so since the recent observations of the species in Brisbane (Moss and Hendry 2021). Since we now have two species of *Acraea* occurring in Brisbane, I thought it would be interesting to look at several natural aberrations of *A. andromacha* that have been recorded, in addition to the aberrations of a related African species, *A. horta*.

The first record of aberrations in *A. andromacha* was a short note I found by Franzen (1915) where he made mention that his son had netted "a melanic form" of *A. andromacha*. Unfortunately, Franzen accompanied his article by a blurry image of the specimen, which I was unable to successfully download. However, I managed to find a similar one illustrated in Burns and Rotherham (1969) which I have reproduced (as best I could) here (Fig. 1). I am aware of another published illustration of an aberrant Glasswing but I have been unable to find reference to it.

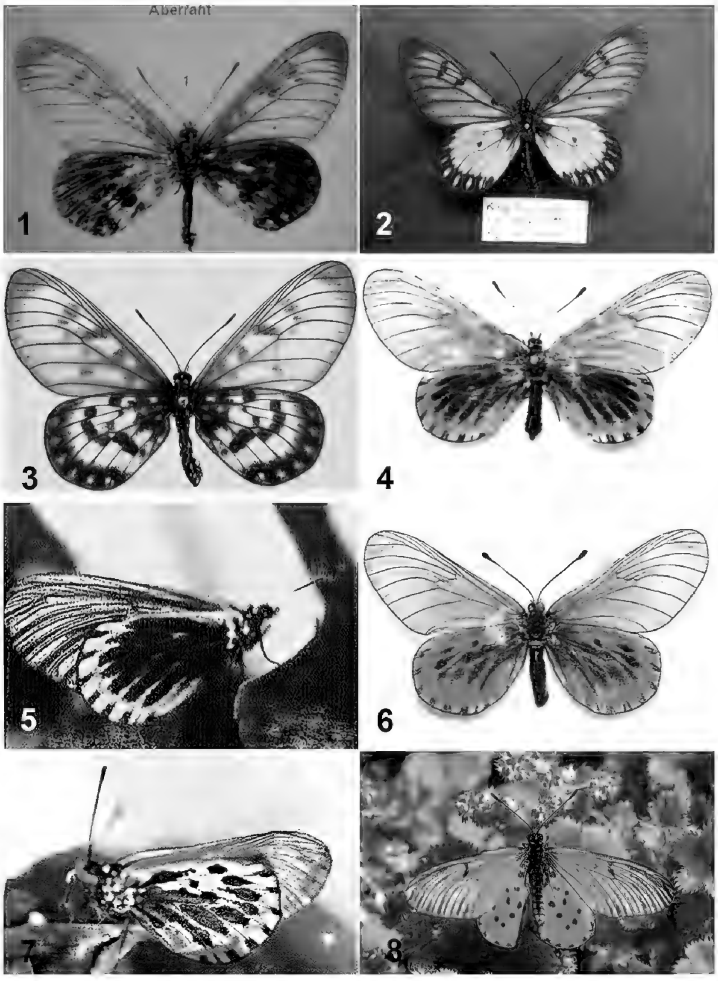
A more recent finding was mention of an unusual, very pale-coloured, Glasswing specimen, caught by BOIC member Steven Kerkow when he lived in Kingaroy, as reported in a Letter to the Editor (Kerkow 2001). Although there was no illustration, the specimen was described as having a covering of creamy-white scales mostly covering the transparent areas of both fore and hind wings including all but the central black spot of the hindwing. I have since photographed the specimen (Fig. 2) with a comparative image of a normal form (Fig. 3).

Regarding this find, Kerkow (2001) commented inter alia:

"One warm October morning I was out chasing butterflies in my backyard in Kingaroy when I came across what appeared to be an old tattered Lesser Wanderer. However, the peculiar gliding flight persuaded me to investigate further. Upon a closer look I immediately realized that this was no Lesser Wanderer, but an aberrant Glasswing (*Acraea andromacha*). This differed greatly from the normal form and probably resulted from a mutation. This butterfly was a rare and exciting find for me as it showed me the possibility for significant variation within a species. I now keep an eye out for any variation as it improves my understanding of butterflies and it opens my eyes to the wondrous things a butterfly can offer."

Sub Saharan Africa [i.e. the Afrotropical Region] has around 250 species of

Acraea, in fact most of the world's species, bar four or five that occur in the regions from India to Australia (Ackery 1984, Hendry 2013). Considering this diverse African fauna, it stands to reason that there would be aberrant forms recorded in some African species. With the assistance of Peter Hendry, we found a record of two aberrant female specimens of the Garden Acraea, *Acraea horta*, bred in captivity by the late Andre Claassens (Claassens 2002). This species is one of the most common and widespread *Acraea* species in South Africa and known to produce aberrations (Claassens 2002).



Figs 1-8. *Acraea* spp.: **1** Aberrant *A. andromacha* (ex. Burns & Rotherham 1969), **2** Aberrant *A. andromacha* (Kingaroy), **3** Normal *A. andromacha*, **4-7** Aberrant *A. horta*, **8** Normal *A. horta*.

In fact, at least two other South African workers had recorded aberrant specimens of *A. horta*, both females. A colleague of Claassens, Woodhall (2000), had pointed out that "melanism in butterflies" (or aberration) characteristically manifests as enlargement and elongation of pre-existing black spots. This can be seen clearly in the images of Claassens' two female specimens which he had labelled as Ab-1 and Ab-2 (see Figs 4-7), compared with an image of a typical *A. horta* (Fig. 8).

Claassens (2002) noted that most records indicate a spring and summer occurrence and not mid-winter as he would have expected. Interestingly, studies by Balinsky (1974, 1977) who reared 10 generations of *A. horta*, did not record any aberrations apart from minor variations. Thus, an inbreeding aetiology for these aberrations has been discounted, but the actual cause remains unknown.

Acknowledgements

I thank D. Edge (African Lepidopterists' Society) for permission to publish photos from the late Andre Claassens. P. Hendry assisted with references and comments on the manuscript. W. Jenkinson provided Fig. 3. C. J. Sharp of Sharp Photography: (http://sharpphotography.co.uk/) provided the image of typical *A.horta*. Thanks to Steve Kerkow for the loan of his aberrant Glasswing for photographing.

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Observations on the life history and larval host plants of the Orange Lacewing *Cethosia penthesilea paksha* (Fruhstorfer, 1905)

Dennis Bell

Introduction

The Orange Lacewing butterfly, *Cethosia penthesilea paksha* (Fruhstorfer, 1905) is restricted to the Northern Territory (NT) where it occurs from Groote Island to the Daly River. It does not occur in Western Australia despite the presence of its larval host plant there. The species is normally confined to monsoon forest where its larval host plant *Adenia heterophylla australis* grows. Despite this, its habitats do vary, for example, the Kakadu escarpment, riparian forest on the South Alligator River and beach monsoon forest at Gunn Point. Outside of Australia, it occurs in the Lesser Sundas and on Timor but is absent from New Guinea.

Life history observations

Despite *C. p. paksha* being solely tropical, it is noteworthy that the butterfly can be raised in Brisbane and will even survive winter as a developing larva. There appears to be no dormancy for eggs, larvae or pupae although development is slower in the colder months. The following observations are from eggs obtained from the Batchelor Butterfly Farm (NT).

Orange Lacewings lay their eggs in groups, typically up to thirty, and are pale yellow in colour (Fig. 1) darkening prior to hatching. They prefer to oviposit on a young stem or a tendril which the female can hold onto comfortably during egg laying. Eggs are also laid on the undersides of leaves, normally near the tip. The end of a growing piece of vine which has broken free and is now hanging down is almost irresistible for egg laying. Height does not seem to be an issue as they will oviposit high up in trees or at ground level. Eggs hatch within about 7 days during the warmer months while during the cooler months this can take up to 20 days.

Larvae remain in a group and feed at the leaf edge preferring to stay under the leaf or clustered at the stem end. Development is rapid and the larvae pupate after 15-20 days during the summer months. They are messy eaters with large larvae choosing to eat through the stems or eating the outer layer of the stem. If *Adenia* is used, they will feed gregariously, primarily start at the end of the stem eating the leaves and stem. Alternatively, if *Passiflora* is used, they prefer to feed singly on the stems almost in preference to the leaves, resulting in a lot of the vine dying.

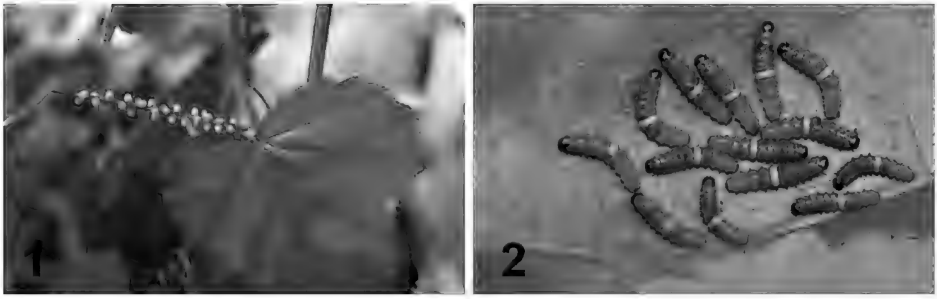
First instar larvae are light brown in body colour (Fig. 2). This darkens to reddish brown for the second instar (Fig. 3). Later instars retain the reddish-brown body

colour however the final instar becomes orange as the larva grows. In the final instar, the lateral white spots and the 'saddle' marking on abdominal segment 4 can be variable in colouration and extent of. The most common form has only abdominal segment 4 white (Fig. 4), however in some individuals, the white markings can be more extensive occurring on thoracic segments 1 to 3 and abdominal segments 2, 4, 6, and 8 (Fig. 5). In addition, a rare dark form is also known, which has a dark brown body colour (Fig. 6). Larvae reach approximately 30 mm at maturity.

Pupation occurs away from the food plant and the larvae can travel considerable distances to find a suitable spot. The end of a dead twig of a shrub or tree in an open position is usually selected. The pupa resembles a dried leaf on the stem ranging in colour from mottled cream to grey (Fig. 7). Pupation period in summer is around 12 days. During the winter months in Brisbane, development is slowed considerably, taking about twelve weeks from the eggs being laid to adults emerging. Typically, eggs laid in late May or early June emerge as adults in late August or early September. Emerging in September is optimal timing for the butterfly lifecycle, allowing the adults to miss the worst of the winter weather and have fresh growth on the *Adenia* plants for egg laying.

From any cluster of eggs there is some variation in the duration of egg to adult emergence. Some larvae are very fast in their development while a few are much slower than the main group and can emerge as adults, weeks after the main group. Perhaps this is a survival mechanism ensuring that not all adults appear at the one time and thus not all will be impacted if bad weather occurs.

In flight, adults of both sexes appear similar. However, males are bright orange (Fig. 8) while the females are duller and orange brown in colouration (Fig. 9). In addition, the males have a more angular forewing and have only a single brown upperside streak in the discal area of the hindwing while the female has two streaks. The undersides of both sexes are similarly patterned (Fig. 10) however the males are slightly brighter orange. Both sexes emerge in equal numbers.



Figs 1, 2. *Cethosia penthesilea paksha* – **1** eggs, **2** first instar larvae.

However, males are more commonly encountered as they are more active fliers. Females prefer rather to sit above or below leaves, unless feeding or searching for food plants.

Adults only require an average sized shade house to fly in. They are an active butterfly but not strong fliers, landing frequently even on the ground and can be accidently trodden on. They readily feed at flowers such as *Penta* sp. and *Duranta* sp. but are particularly fond of the blue flowers of snake weed (*Stachytarpheta jamaicensis*) however this is a very weedy plant and can be spread readily by seed.

Adults can be expected to live for about six weeks. Egg laying is usually quite prolific with females laying every two to three days once they have found a vine they prefer. They can easily overpopulate their environment and defoliate smaller plants. This may provide a trigger for their dispersal in the wild as they are generally content to remain in an area if the food plant is available.

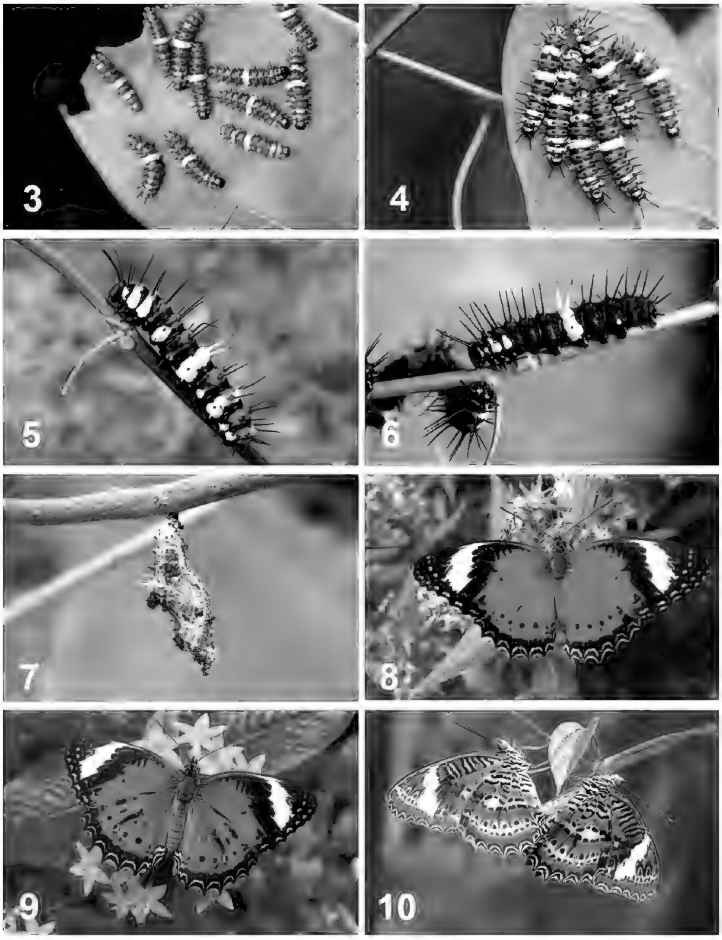
Notes on suitability of some larval hostplants

For rearing the butterfly in Brisbane during winter, a key issue is to provide host plant during these colder months. Unfortunately, the NT *Adenia* ssp. (*A. h. australis*) is cold sensitive and attempts to grow the plant in Brisbane through winter invariably result in failure. By June the plant has lost all its leaves and by late July even the stem shows cold damage and eventually the plants die. The Queensland ssp. (*A. h. heterophylla*) (Figs 11-13) is much less cold sensitive and can be grown in Brisbane although it is deciduous over winter. An even more cold resistant form or ssp. occurs in monsoon scrubs of Cape York Peninsula and this one retains its leaves during Brisbane winters. It is this form which I use to raise butterflies.

The other difficulty with growing *Adenia* plants is their sensitivity to nematode infestation. If grown in garden soil where nematodes occur, the plants are infected and most likely will die. Unfortunately, garden soils most often have nematodes, but in the wild, rainforest areas generally have fewer nematodes because of their isolated nature, extensive drying out periods (or flooding) and the complex soil biota. One way to overcome the nematode problem, is to grow plants in large pots using potting mix raised above the ground. Under these conditions the plant can grow rapidly (over summer) producing 6 metre or longer stems thus providing a large amount of leaf material for larvae.

In addition to *A. heterophylla*, Orange Lacewings will use some *Passiflora* spp. as larval host plants, notably *P. aurantia*, *P. caerulea* (Fig. 16) and a glabrous form of *P. foetida* (Fig. 15). Eggs are readily laid on and larvae readily feed on *P. aurantia* but *P. aurantia* is also susceptible to nematode attack as is the case with many native *Passiflora* spp. Another suitable *Passiflora* species, is the exotic *P. caerulea* (Fig. 16) as it provides a suitable food source, is not cold sensitive and seems to be

resistant to nematodes. Eggs are freely laid on fresh shoots of the plant and larvae develop normally. This plant grows particularly well, spreading via underground stems and puts up large stems which provide enough leaves and stems to meet the needs of a batch of butterfly larvae. However, during the colder months the best survival is achieved if *Adenia* is used to feed larvae for at least the first two instars. Interestingly *P. kuranda*, a native species found in rainforest areas near Cairns, is not a suitable host plant. Butterflies oviposit on this plant, but the young larvae die. Final instar larvae will reluctantly eat and will not survive on the plant.



Figs 3-10. *Cethosia penthesilea paksha* – **3** second instar, **4, 5** final instar, **6** final instar dark form, **7** pupa lateral view, **8** adult male upper, **9** adult female upper, **10** male (left) and female (right) in copulation.

Some larval host plants

Adenia heterophylla heterophylla

This is a large vine which grows in jungle locations either climbing up trees using its tendrils or trailing along the ground. Small flowers are produced on the tendrils (Figs 11-13). *Adenia h. heterophylla* occurs in northern Queensland while *A. h. australis* occurs in the NT and in the Kimberleys of Western Australia. The northern Queensland subspecies is suitable for Brisbane's climate as it is the most adaptable to cold weather and can still provide large leaves for feeding larvae even during winter. It doesn't grow between June and August but still retains its leaves. During summer it is fast-growing, best in semi-shade with a small tree to climb. If grown in a large pot it can be fertilised and watered to maximise growth. Propagation is best by cutting which strike readily in warm weather. It will grow well from seed but doesn't set seed readily in Brisbane.

The plant is also a larval host plant for the Red Lacewing (*Cethosia cydippe*), Cruiser (*Vindula arsinoe*) Glasswing (*Acraea andromacha*) and Tawny Coster (*A. terpsicore*) butterflies. The Glasswing and Tawny Coster prefer open areas and often ignore seemingly good plants in shade, so position of host plants is important when rearing these species. Overall, *A. h. heterophylla* is the preferred host plant for these butterflies as the first instar larvae have a high survival during winter, while the larger leaves can support many mature larvae, particularly using the older thicker leaves. However, using alternative host plants particularly from the third instar onwards is useful for easing the pressure on the host plants.

Passiflora aurantia aurantia

P. a. aurantia is a medium sized native vine with thin wiry stems which grow quickly and produce spectacular red flowers (Fig. 14). It prefers an open sunny position in well-drained soil. Plants are often not long lived and can die suddenly. Propagation is best from seed from fermented and dried fruit which is usually found in litter around the plant. The seed will usually germinate readily over an extended period. It will grow readily in Brisbane even during winter and can be used to feed Orange Lacewing larvae if *Adenia* plants are defoliated. The larvae will switch between host readily. They can do much damage to a vine particularly a large number. Only mature vines can cope with feeding by many larvae as larvae tend to eat stems and bark, often in preference to leaves, resulting in stems dying. In addition to Orange Lacewings, the vine is also a good larval hostplant for all the butterfly species mentioned earlier and is a very good host plant for Glasswings; they will oviposit readily on it and it gives good larval survival.

Figs 11-13. *Adenia heterophylla heterophylla*, **Fig. 14.** *Passiflora aurantia aurantia*, **Fig. 15.** *P. foetida*, **Fig. 16.** *P. caerula*. (Fig. 13. per G. Sankowsky)

A short note on Wülfing's Stick-Insect, *Acrophylla wuelfingi* (Phasmatidae: Phasmatinae) observed at Malanda, Qld

Bill Graham

This very large stick insect was found on the wall of my house in early April 2021. I live on a rainforest block outside Malanda, in northern Queensland. A recently felled, very large tree may have flushed it from the canopy as I have not encountered this insect before. When first approached, it remained motionless, and I was able to measure it quite easily. Excluding the short antennae, its body length was 29.5 cm from head to the tip of the abdomen (Fig. 1). The front legs when extended were 20 cm long making it almost half a metre long (Fig. 2). Its legs and thorax are covered in saw-tooth needle sharp spines (Fig. 3). It has wings but didn't attempt to fly. When handled it became quite agitated and coiled its long abdomen and used its wings to apparently hide its soft abdomen from view while the long front legs were held together and extended forward (Fig. 4). If a hand was ventured too close, it would strike in a "club-like" motion using its whole body in the action. The force of the striking with the needle-sharp spines could easily puncture human skin. This defensive response was repeated every time a hand came too close. These wouldn't make good pets! To me this is the most awesome insect I have ever encountered. Its huge size, formidable body armour and aggressive behaviour make this a unique creature. (I thank Trevor Lambkin, Brisbane for assisting with its identification, *Acrophylla wuelfingi*)

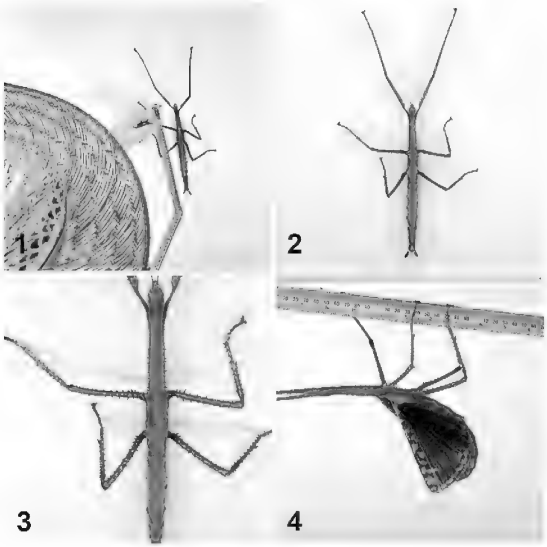


Fig. 1-4. Female *Acrophylla wuelfingi* observed at Malanda, Qld in April 2021.

Some of Australia's myrmecophagous Lycaenid butterflies

(Transcript of presentation at the BOIC General Meeting, Karawatha Forest Discovery Centre, 15 May 2021)

Peter Samson

The Lycaenidae – blues, coppers and hairstreaks – is the largest butterfly family in Australia, containing small to medium-sized butterflies that are often brilliantly coloured on the upperside.

Many lycaenids have particularly interesting life histories, associating with ants in their larval and pupal stages. Most larvae have special adaptations to encourage this relationship: a dorsal nectary organ or Newcomer's organ on the seventh abdominal segment which produces a liquid secretion that ants feed upon, a pair of eversible tentacular organs on abdominal segment eight which produce volatiles that probably release an alarm reaction in the ants, and various epidermal glands. Some larvae and pupae stridulate, producing vibrations and sounds that may affect behaviour of the attendant ants. From this relationship, the immature stages get some protection from attack by parasitoids, predators, and the ants themselves.

The strength of the butterfly-ant relationship varies among species. Some lycaenids are seen with ants only occasionally, but others have obligate ant relationships, they are always associated with ants and usually a particular species of ant. Most of the latter group feed on plants while being attended by ants but a few species actually eat their ant associates – myrmecophagy. Myrmecophagy is known or believed to occur in four genera of Australian lycaenids.

One of these is the genus *Ogyris*, the Azures. Most of the Azures feed on mistletoe as larvae. However, there are several southern and south-western species that are very different. Their adults lay eggs at or near the entrance to underground nests of *Camponotus* spp. ants; *O. subterrestris* (Arid Bronze Azure) lays eggs at the base of eucalypts while adults of *O. idmo* (Large Bronze Azure) and *O. halmaturia* (Eastern Bronze Azure) lay eggs near or into the nest entrance. Larvae of all three species spend their development underground and are presumably fed by the ants or feed on ant brood, but so far this has not been observed.

The second is the genus *Arhopala*, the Oak-blues. There are three mainland Australian species that feed on a variety of plants while always attended by Green Tree Ants, *Oecophylla smaragdina*. However, the life history of the fourth species, *A. wildei* (White Oak-blue) (Fig. 1), wasn't discovered until the 1990s (King and Ring 1996; Eastwood and King 1998). Females lay eggs on the outside of arboreal nests of the ant *Polyrhachis queenslandica*. These ants aren't inclined to leave the nest during daylight, but instead respond to threats by drumming against the inside of the nest, creating a very audible rattling sound. Ants carry the newly hatched larvae into the nest where they feed on the ant brood (Fig. 2).

Figs 1,2. White Oak-blue, *Arhopala wildei*: **(1)** adult male; **(2)** final instar larva with *Polyrhachis queenslandica* ants.

All members of the genus *Acrodipsas*, the Ant-blues, will almost certainly be myrmecophagous. The number of known species of *Acrodipsas* keeps expanding: in the early 1970s there were four named species (originally listed under *Pseudodipsas*) whereas now there are 11 species. *Acrodipsas* are very local and many are only

collected regularly on hilltops, mostly as males. There have been detailed observations of the life history of only three, *A. cuprea* or Copper Ant-blue (Gooding 1971), *A. illidgei* or Mangrove Ant-blue (Samson 1989) (Fig. 3) and *A. myrmecophila* or Small Ant-blue (New and Britton 1997). All develop within ant nests.

Figs 3,4. Mangrove Ant-blue, *Acrodipsas illidgei*: **(3)** adult male; **(4)** mature larva with *Crematogaster* sp. (*laeviceps* group) ants.

First instar larvae of the latter two species are carried into nests of their host ants, *Crematogaster* sp. (*laeviceps* group) (Fig. 4) and *Papyrius* sp. (*nitidus* group) respectively, where they complete their development while feeding on immature ants.

The last genus of myrmecophages is *Liphyra* which contains only one species in Australia, *L. brassolis*, the Moth Butterfly. Larvae of *L. brassolis* have been known since the early 1900s to live inside nests of the Green Tree Ant, where they were presumed to be myrmecophagous, but this was not confirmed until photographic evidence was obtained by Johnson and Valentine (1986). The larvae are unlike any other Australian lycaenid, being lozenge-shaped with a leathery dorsal surface and a projecting rim that protects the legs and soft undersurface from ant attacks (Fig. 5). To feed, larvae grasp ant larvae and draw them under the protective rim (Fig. 6). When mature, the larval skin is not shed but instead is retained as a hard puparium that protects the vulnerable pupa inside (Fig. 7). This must be one of our most unusual butterflies. Finally, Figures 8 and 9 illustrate the similar myrmecophagous feeding behaviour of the former two species discussed, *A. wildei* (8) and *A. illidgei* (9).

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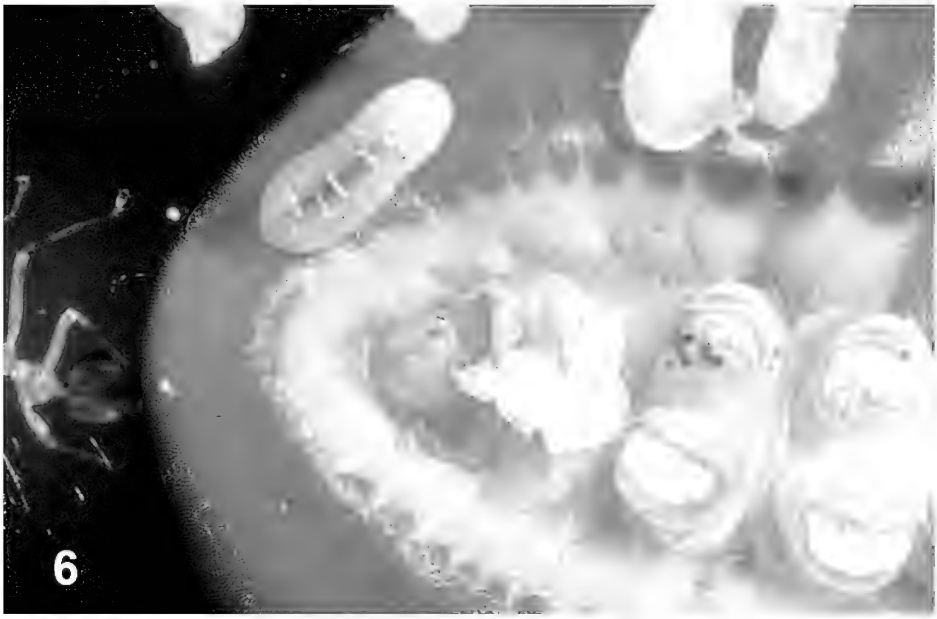
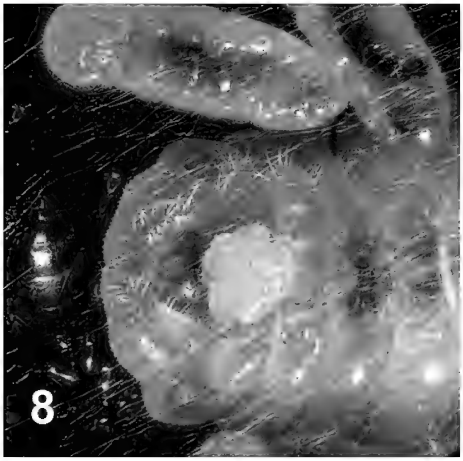
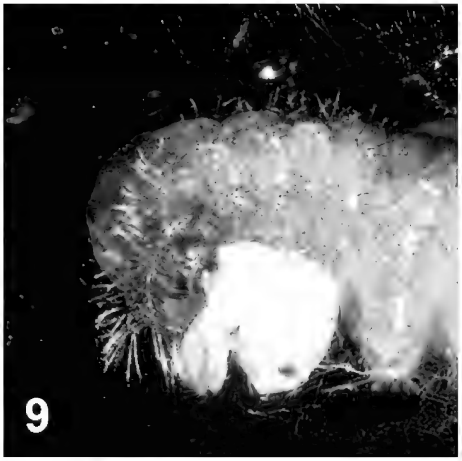


Figs 5,6. Moth Butterfly, *Liphyra brassolis*: **(5)** mature larva with Green Tree Ants *Oecophylla smaragdina*; **(6)** mature larva eating a larva of a Green Tree Ant.

Fig. 7. Adult female *L. brassolis* recently emerged from the pupa and puparium.





Figs 8,9. Predation on ant brood by myrmecophagous lycaenid larvae: **(8)** White Oak-blue *A. wildei* larva eating a larva of *Polyrhachis queenslandica*; **(9)** Mangrove Ant-blue *A. illidgei* larva eating a pupa of *Crematogaster* sp. (*laeviceps* group).

Samford Eco-Corridor Invertebrates Survey

Peter Storer

On 6 March 2021, 15 members of the BOIC and 6 community members carried out a butterfly survey (while also noting other invertebrates) at the Eco-Corridor, which is situated in the Parklands just north of Samford Village. This is the second such survey by the Club, with the last being held 3 years ago (the 2020 survey had to be cancelled owing to Covid-19). Attendees came from far and wide, including Ben and Jean Grundy who travelled all the way from Gowrie Junction, north-west of Toowoomba. The collectors identified small butterflies and other flying insects by 'capture and release' using large nets. The specimens were placed in small bottles for close observation before releasing them unharmed. Larvae and other sedentary invertebrates were photographed in situ, noting the host plant species, if known. In total, we recorded adults and/or larvae of 21 butterflies and 5 moths, plus 5 beetles (including ladybirds), 4 flies, 3 wasps, 2 grasshoppers, 1 lacewing; 5 spiders, 1 cockroach and 9 bugs/leafhoppers (Hemiptera), but would have barely scratched the surface of the invertebrate diversity on site. We thank Dawn Franzmann for compiling the detailed list. Thanks also to Bernie Franzmann, Peter Hendry and Greg Anderson for additional help with identification.

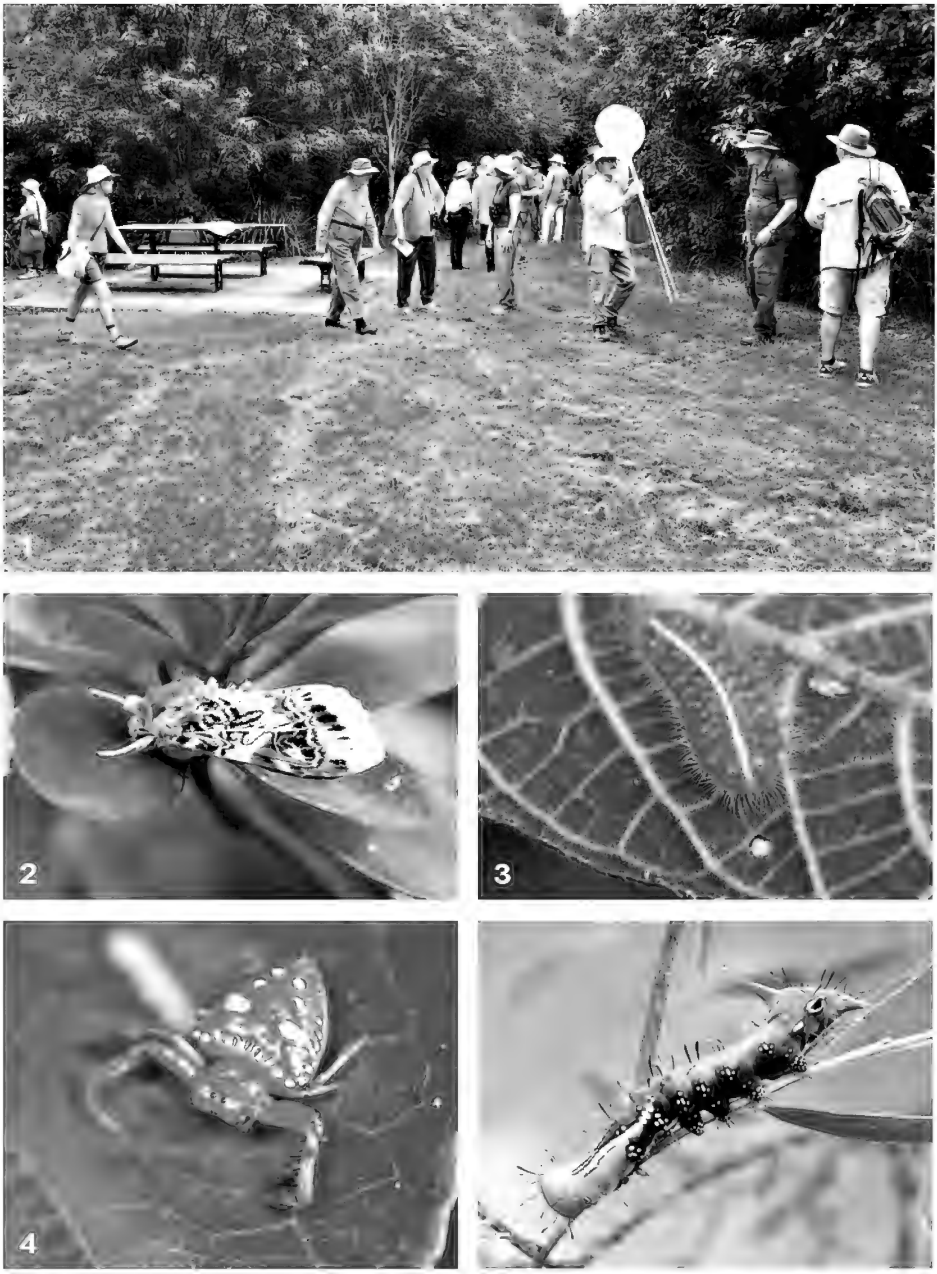
SAMFORD ECO CORRIDOR
BUTTERFLIES & OTHER INVERTEBRATES SURVEY
6 MARCH 2021

BUTTERFLIES & MOTHS
ORDER: Lepidoptera

Common Name	Scientific Name	Family
Blue Triangle	*Graphium sarpedon*	Papilionidae
Scarlet Jezebel	*Delias argenthona*	Pieridae
Evening Brown	*Melanitis leda*	Nymphalidae
Purple Moonbeam	*Philiris innotata*	Lycaenidae
Orange Ringlet	*Hypocysta adiante*	Nymphalidae
Splendid Ochre	*Trapezites symmomus*	Hesperiidae
Clearwing Swallowtail	*Cressida*	Papilionidae
Speckled Line Blue	*Catopyrops florinda*	Lycaenidae
Meadow Argus	*Junonia villida*	Nymphalidae
Common Grass Blue	*Zizina otis*	Lycaenidae

Common Name	Scientific Name	Family
Yellow Palm Dart	*Cephrenes trichopepla*	Hesperiidae
Wanderer	*Danaus plexippus*	Nymphalidae
Common Eggfly	*Hypolimnas bolina*	Nymphalidae
White Migrant	*Catopsilia pyranthe*	Pieridae
Orchard Swallowtail	*Papilio aegeus*	Papilionidae
Small Grass Yellow	*Eurema smilax*	Pieridae
Common Crow	*Euploea corinna*	Nymphalidae
Blue Tiger	*Tirumala hamata*	Nymphalidae
Cabbage White	*Pieris rapae*	Pieridae
Lemon Migrant	*Catopsilia pomona*	Pieridae
Large Grass Yellow	*Eurema hecabe*	Pieridae
Grass Moth	*Herpetogramma licarsisalis*	Pyralidae
Moth	*Anthela* sp.	Anthelidae
Moth caterpillar	*Orvasca aliena*	Erebidae
Moth caterpillar	*Antithemerastis acrobela*	Notodontidae
Moth caterpillar	*Neola semiaurata*	Notodontidae
Moth caterpillar		Noctuidae
BUGS **ORDER: Hemiptera**		
Leaf Hopper		Cicadellidae
Stink Bug		Pentatomidae
Rice Bug	*Leptocorisa* sp.	Alydidae
Plant Hopper		Flatidae
Common Assassin Bug	*Pristhesancus plagipennis*	Reduviidae
Red Assassin Bug	*Trachylestes aspericollis*	Reduviidae
Green Jewel Bug	*Lampromicra senator*	Scutelleridae
Green Stink Bug	*Plautia affinis*	Pentatomidae
Gum Tree Shield Bug	*Poecliometis histricus*	Pentatomidae
GRASSHOPPERS, CRICKETS & KATYDIDS **ORDER: Orthoptera**		
Long Horn Grasshopper		Tettigoniidae
Short Horn Grasshopper		Acrididae

LACEWINGS ORDER: Neuroptera		
Common Name	**Scientific Name**	**Family**
Green Lacewing eggs & larvae	*Mallada signatus*	Chrysopidae
COCKROACH ORDER: Blattodea		
Ellipsidion Cockroach	*Ellipsidion* sp.	Blattellidae
BEES, ANTS & WASPS ORDER: Hymenoptera		
Parasitic Wasp		Ichneumonidae
Flower Wasp		Tiphiidae
Paper Wasp		Vespidae
FLYS ORDER: Diptera		
Bristle Fly		Tachinidae
March Fly		Tabanidae
Soldier Fly		Stratiomyidae
Long-legged Fly		Dolicopodidae
BEETLES ORDER: Coleoptera		
Leaf Beetle		Chrysomelidae
Longicorn Beetle		Cerambycidae
Striped Ladybird	*Micraspis frenata*	Coccinellidae
Variable Ladybird	*Coelophora inaequalis*	Coccinellidae
Twenty-eight Spotted Ladybird	*Epilachna vigintioctopunctata*	Coccinellidae
SPIDERS ORDER: Arachnida		
Jumping Spider	*Mopsus mormon*	Salticidae
Crab Spider		Thomisidae
Triangular Spider	*Arkys lancearius*	Arkyidae
Two-spined Spider	*Poecilopachys australasia*	Araneidae
Garden Orb Weaver	*Eriophora transmarina*	Araneidae
St Andrews Cross Spider	*Argiope keyserlingi*	Araneidae

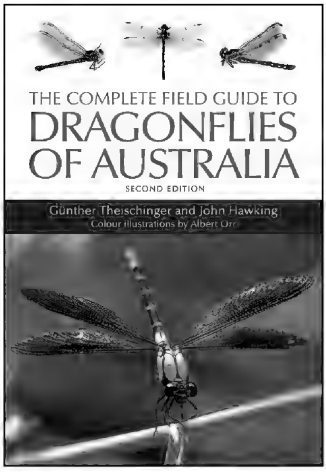


Figs 1-5. 1 Participants in the Eco Corridor Survey, **2** *Anthela* sp. Moth, **3** Common moonbeam butterfly larva, *Philiris innotata*, **4** Crab spider, **5** *Neola semiaurata* moth larva.

The Complete Field Guide to Dragonflies of Australia, 2nd Edition, by Günther Theischinger & John Hawkins, Colour Illustrations by Albert Orr

CSIRO Publishing, Clayton South, xiv + 406 pp.

Reviewed by Roger Kitching



In my review of *Dragonflies and Damselflies of the Gold Coast* (*Metamorphosis*, **100**, 39-40), I foreshadowed the imminent publication of this eagerly awaited volume. The book has now arrived and I get to introduce it to you.

First, let me comment on the series of which this is a part. In 2004 CSIRO Publishing released the first edition of their *Complete Field Guide to the Butterflies of Australia*, a sort of updated pocket edition of Michael Braby's definitive two-volume (and commensurately expensive) *Butterflies of Australia* (2000). This *Field Guide* format clearly resonated and they have subsequently published no fewer than eleven further guides in uniform format dealing with various groups of insects (and a twelfth on *Spiders*). These range in subject matter from general guides to huge faunas (eg. *Beetles, Moths, Spiders*) to more focussed introductions to smaller groups (eg. *Cockroaches, Stag Beetles, Native Bees, Stick & Leaf Insects*). All, however, have very high production standards and scientific standing. Those fascinated by both invertebrates and books would do well to complete their collections: some are already reduced to e-status only.

Only two of the series have stretched to second editions and it is one of those that we examine here. As I have commented previously, after the butterflies, the odonates (dragonflies and damselflies) attract perhaps most interest and enthusiasm. The Australian odonate fauna now comprises about 333 species (although the occurrence of a couple is questionable). It is interesting to think about the discovery of this rich fauna. As with many groups of insects, the first Australian odonate was described by Johan Christian Fabricius based on material collected on Cook's Endeavour voyage. This was the so-called Painted Grasshawk (*Neurothemis stigmatizans*) described by Fabricius in 1793. For the next 130 years or so the known fauna very gradually increased so that my copy of Tillyard's *Insects of Australia and New Zealand* (1926)

suggests an Australian fauna of 201 species (many described by Tillyard himself). By the time that the first general guide to Australian Odonata was published in 1960 (Fraser, 1960) only six additional species had been added. Then Günther Theischinger and Tony Watson happened and, over the next 50 years, an additional 126 species have been added to the list – most as brand new species. I mention Theischinger and Watson because, of the 97 new species of odonates described from Australia since 1960, they are responsible, as authors, separately or together, occasionally with others, for no less than 91. No other author has managed more than a single description.

Accordingly it's no surprise that, after Fraser (1960), the next general guide to was *The Australian Dragonflies* (1991) by Watson, Theischinger & Abbey. This described 302 species. One of Australia's entomological tragedies then happened. Tony Watson died prematurely in 1993 (aged just 58). Tony was a good friend of mine from the time we were both research scientists within CSIRO's Division of Entomology. His passing was a huge blow to entomology in general (he was also THE specialist on Australian termites, silverfish and some groups of beetles) but his parting from the odonatological community was a global tragedy. The Australian odonatological 'baton' passed to Theischinger, Hawking, Orr, Burwell, Endersby and others. So, again, it was no great surprise that the next commercially published guide, the *first* edition of the book currently being reviewed, was by Theischinger and Hawking. Published in 2006, this work set a new standard in clarity of production. It described 324 species illustrating each with photographs (mostly of living specimens) accompanied by anatomical drawings of key differentiating structures. The work also contained illustrated keys to families, genera and many species plus a guide to final stage larvae.

This general pattern is maintained and updated in the 2021 edition but there are further significant changes, some cosmetic, some of more substance.

Probably of most scientific importance is that the vast majority (311 of 333) of species are now arranged into families following a so-called consensus paper (Dijkstra *et al.* 2013) that unified usages and taxonomy (at least for the time being) for the Odonata globally. Both Theischinger and Orr were among the flock of co-authors of that paper. In many instances this arrangement differs substantially and fundamentally from the categories used in the first edition and represents, as the authors point out, 'more conservative' groupings. Twenty-two Australian species remain as *incertae sedis*: that is, they cannot be confidently assigned to families at this stage.

The other key scientific point is that this work describes the nine additional species recognized since 2006. Some of these additions are the results of taxonomic

revisions, a couple join us only on Dauan Island in Torres Strait, one new species (in both distributional and taxonomic senses) may be a vagrant from New Zealand, and five are undisputed new species described from Australia between 2007 and 2020. The most recent of these is *Nannophya fenshami* Theischinger, the Artesian Pygmyfly, which lays claim to be the world's smallest dragonfly and hails, as the common name implies, from artesian springs in Queensland. A further enigmatic species is the well-named Summit Mystic (*Austrophya monteithorum*) known only from a single larva collected at high elevation on a North Queensland mountain.

Other changes to the new edition could be regarded as cosmetic yet increase the usefulness of the work greatly. The front cover now displays a large photograph by Bert Orr (not, for once, by Theischinger, as the copyright page claims) of *Diphlebia coerulescens* – the bright blue, endemic Sapphire Rockmaster which replaces the first edition's *Diplacodes bipunctata*, the Wandering Percher, a non- endemic found widely in the south-western Pacific region. Orr also adds greatly to the work as the illustrator of 34 species of adult odonates arranged as 12 plates. A reproduction of one of these superb works of art is included here (it is Plate 12 in the book). Orr has built an enviable reputation as an entomological artist starting with the seminal *Dragonflies of Borneo* (Orr, 2003) followed by other works on the Asian and New Guinea odonate faunas (as well as our jointly authored *The Butterflies of Australia*, 2010). During that 18 year period his expertise and technique have evolved (they were pretty good to start with) especially when it comes to representing the subtle iridescences and contours of some odonate wings (as of the Jewel Flutterer, *Rhyothemis resplendens*, in the Plate reproduced here). This skill is particularly evident in some of his illustrations for *The Metalwing Demoiselles of the Eastern Tropics* (Orr & Hämäläinen, 2007). For the present volume, Orr's plates add beauty and utility and, alone, are reason to buy this second edition (even if you already have the first).

I should add a further note of self-interest here. I supervised Orr's PhD studies, and Günther Theischinger was a volunteer on some of the early Earthwatch expeditions which I organised and led.

So, to conclude: this a superb book, a work of scientific distinction and a handsome volume to own and browse. As an Australian entomological community, we may have been blessed with relatively few odonatologists but they have done handsomely by us in providing superb, affordable tools to further our crafts of observation, collection and identification – and the quality just grows with each new contribution.

I am grateful to Dr Albert Orr for providing me with the file for the Plate and for permission to reproduce it here.

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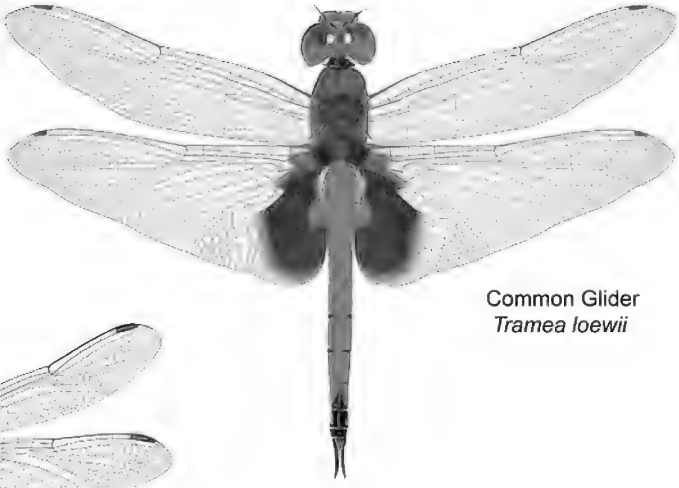
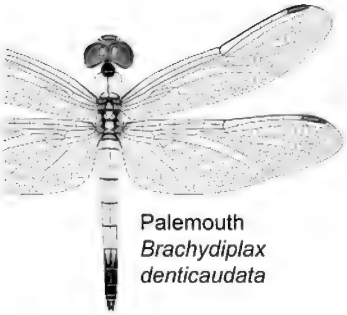
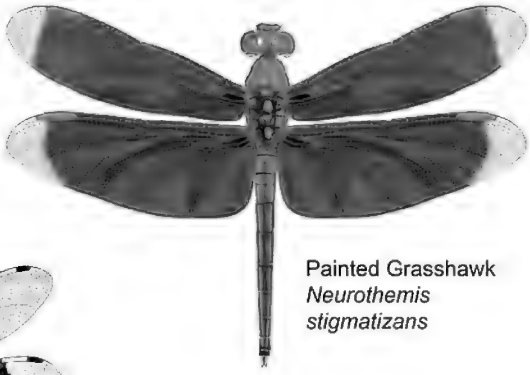


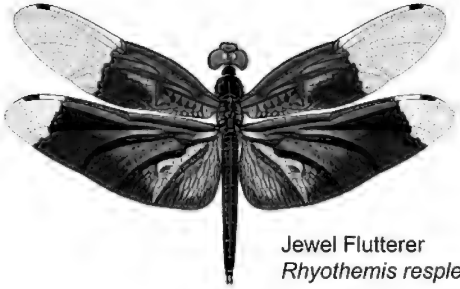
Common Glider
Tramea loewii



Palemouth
Brachydiplax denticaudata



Painted Grasshawk
Neurothemis stigmatizans



Jewel Flutterer
Rhyothemis resplendens

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Bee Detectives by Vanessa Ryan-Rendall & Brenna Quinlan

CSIRO Publishing, Clayton South: www.publish.csiro.au/book/7962 $24.99

Reviewed by Judy Ferrier

The children's book, *Bee Detectives*, by Vanessa Ryan-Rendall and Brenna Quinlan, recently published by CSIRO is ideally targeted to lower primary school students. The use of strong colours and cartoon characters in the illustrations would appeal to young readers and capture their attention. The central characters of Hamish and Olivia with their pet guinea pig would allow young readers to readily associate with the intrepid pair as they set out on the adventure of discovering that there are many types of native bees in their backyard and the differences between them.

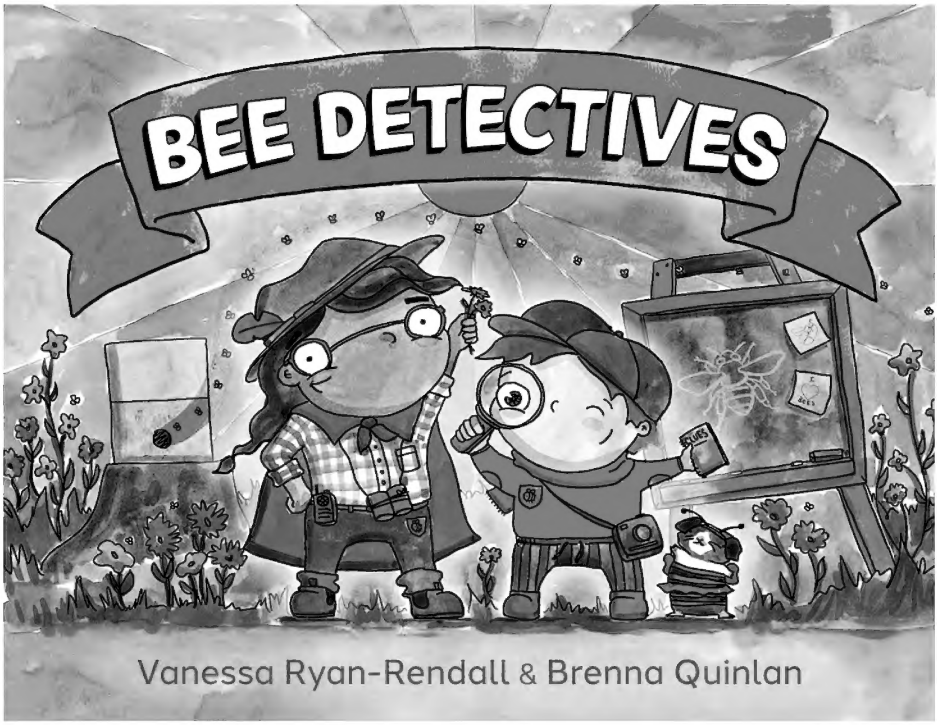
The accompanying teacher notes prepared by Joanna Durst, that are available on the CSIRO website lift the educational experience of the young reader to allow the opportunity to research larger concepts such as life cycles, classification of the animal kingdom and fertilization of plants. Children can expand their vocabulary with the use of more sophisticated terms to describe process, people and phenomena. Most of these more challenging terms are covered in the glossary but at times their definition could have been a good inclusion placed next to the word in the text. However, by not doing so, teaches the child the skill of referring to a glossary during their reading to assist with comprehension.

The inclusion of the glossary and the appendices, "Tips" and "Extra Information", is one of the strengths of the book. Perhaps within this section, the role of sugar bag honey in the indigenous people's diet and their knowledge of the bees' hives and collection methods could have been covered to emphasise that native bees have been part of the Australian landscape for a long time.

The book encourages the reader to create their own "bee hotels" in their outdoor space. Without being overly instructive, the sketches of possible "nests" and the advice in the "Tips" section is a great starting point. Again, further research into building their native beehives, assists their learning process on how to access detailed information from other sources, and the actual construction process allows the child to be creative, analytical and use their fine motor skills to a good use.

While the book offers many educational experiences for the child, it has at its core a delightful story. Children will respond readily to the mystery of the black cloud, the revelation of its source and the explanation of how these tiny insects live in our backyards. Their eyes will be opened to the wonder of nature and how it is ever present around us but often unrealized as we don't observe closely the environment that is right at our back door.

Bees are an integral part of our ecosystem and it is heartening for children to read a story that shows them as industrious providers for both people and plants and not merely pesky insects that can deliver a painful sting. The book is both an enjoyable read and at the same time enlightening – the standards of a good story.



GUIDELINES FOR AUTHORS

Text to be 11 font size Times New Roman with 1.5 times New Roman spacing. Images are to be a minimum of 300dpi, originals separate to the document and captions provided for each image. Adherance to the deadlines for submission would be greatly appreciated.

All articles/contributions to be submitted to the Editorial Committee at secretaryboic@gmail.com.

CONTENTS